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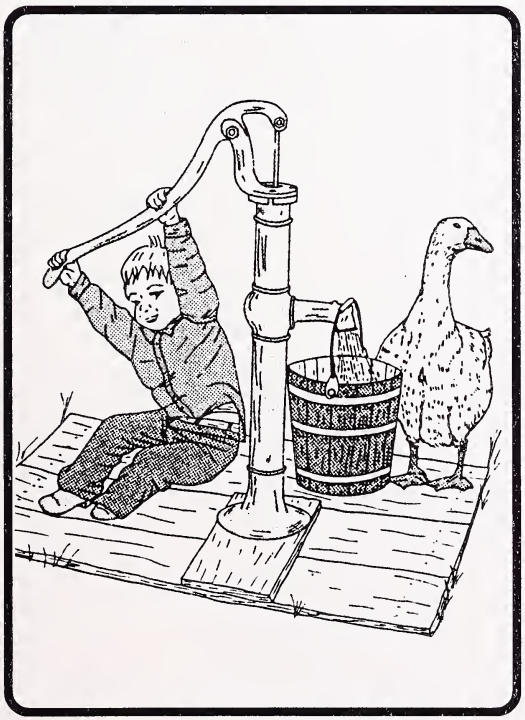
water Well Drilling for the Prospective Well Owner



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Introduction

Do you plan to have a well? If so, this pamphlet is for you. It covers information that every prospective owner of an individual well should know.

Fourth Edition
1996

How Much Water Do You Need?

You will need a dependable water supply for your present and future uses.

Each of us on the average uses about 100 gallons of water per day. For a family of four, this means that a domestic well should provide a dependable yield of 10 to 25 gallons per minute (gpm) to adequately supply all needs, including lawn and garden watering. Much smaller yields may be acceptable, if adequate storage tanks are used. Most mortgage companies require a well yield of at least 5 gpm. More specific information is available from county sanitarians, engineering firms, water well contractors, or pump installers.

Before you have your well drilled, find out from a local drilling contractor, the Montana Department of Natural Resources and Conservation (DNRC), or the Montana Bureau of Mines and Geology (MBMG) how much water can be produced from the aquifers in your area, the chemical quality of that water, and the depth to the water supply. You should also examine the logs of wells drilled in your local area or talk with people in the vicinity about their wells. The DNRC Water Resources Regional Office in your area and the Montana Bureau of Mines and Geology in Butte or Billings have copies of all well logs in the state and should be able to assist you. Their phone numbers and addresses are listed in the back of this booklet. Before contacting these organizations, try to have an accurate land description down to at least township, range, and section of the area in which you plan to locate your well.

Various conditions make it impossible to guarantee that a well contractor will find an adequate supply of groundwater at your location. For example, the geology in an area may be such that groundwater is not available at your site even though a neighbor's well, a few feet away, is a good producer. It is not advisable to build your home until you know you have an adequate water supply on your building site.

How Do I Select a Water-Well Contractor?

This is perhaps the most important step in installing your well. The names of water well contractors in your area are available from various sources, including:

County health departments

Lending institutions

Well owners in the area

Normal advertising sources

If you wish to verify a driller's license, you may contact the Board of Water Well Contractors, DNRC, 48 North Last Chance Gulch, Helena, Montana 59620-1601, phone (406) 444-6643.

Each DNRC Water Resources Regional Office has a list of licensed drillers in the local area.

Seek information on the contractor's:

Reputation
Reliability
Equipment
Competence
Experience

Once you narrow your selection, ask yourself the following questions in deciding who will drill your well.

1. Is the contractor licensed by the Montana Board of Water Well Contractors and bonded to the State of Montana as a water well contractor?

State law requires drillers to be licensed by the Board of Water Well Contractors. Licensing is important to help ensure competency in drilling. Should a dispute arise between a driller and a client, the Board of Water Well Contractors can resolve the dispute better if a licensed contractor is involved than if the complaint is against an unlicensed individual. **Note:** A general contractor's license issued by the Montana Department of Commerce does not authorize the holder to drill water wells.

2. Will a written contract be provided? A written contract protects both the well owner and the contractor by avoiding misunderstandings that may arise as to the type of materials (e.g., casing, pump) to be used, the quality and quantity of water to be delivered, the anticipated well depth, and the financial agreement. This is the time to set a maximum depth the driller cannot exceed without expressed agreement by the owner. To avoid misunderstandings, the terms under which the additional drilling will be completed should be in writing.

3. Is the contractor willing to provide a written, itemized estimate of the costs of drilling your well?

Costs that should be itemized are:

a. Cost of mobilization of equipment
b. Cost per foot of drilling

c. Cost per foot of casing
d. Cost of sealing materials and labor involved
e. Cost of other materials (e.g., drive shoe, screen, perforated casing)
f. Cost of development
g. Cost of pump test on well
h. Cost of grouting
I. Cost of pump and accessories if they are to be installed by water well contractor
j. Cost of disinfection
k. Cost of testing

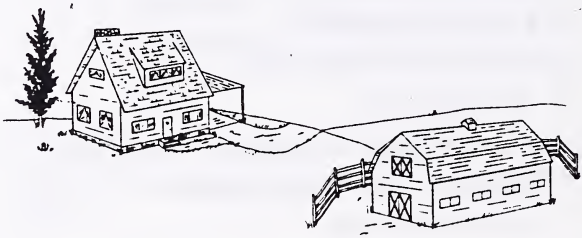
4. Who will be responsible for site cleanup?
The equipment used in drilling is heavy and will damage lawns by leaving depressions. In addition, large volumes of water and mud are often produced. You should decide before the well is started what precautions need to be taken to contain this water and mud. Site cleanup is usually left up to the well owner.

5.When will copies of well logs be given?
State law requires that a copy of the well log be submitted to the Montana Department of Natural Resources and Conservation within 60 days after completion of the well by the driller.

6. What type of guarantee does the contractor provide on workmanship and materials?
State law requires contractors to guarantee that all materials and equipment are new, unless specified, and that their work is free from defects for at least one year. It is important for you to notify the contractor immediately of any defects or problems with the well construction, materials, or workmanship. Any guarantees on the quality of water produced by the driller - particularly in regard to turbidity - should be discussed beforehand.

7. Who will be responsible for sizing and placement of the pump? Proper pump size and type are important to ensure adequate water pressure. It is not advisable to purchase a pump prior to the drilling of the well.

What Is Important in Properly Locating the Well?



Consider the relative elevations and locations of septic tanks, drain fields, stockyards, and other sources of contamination. Some areas have unique geologic features that should be investigated to be sure that they won't lead to contamination of the well. Take neighboring sewage disposal systems into consideration.

You can obtain information on the location of septic systems from the county sanitarian at your local health department. A well should be a minimum of 10 feet from the property line, 50 feet from any septic tank, and 100 feet from the drain field. As the landowner, you should locate all buried pipes and septic systems before the contractor arrives. This will avoid any problems for the contractor in setting up the rig.

To promote convenience and reduce costs of installation and maintenance, keep the following in mind when locating the well and supply line.

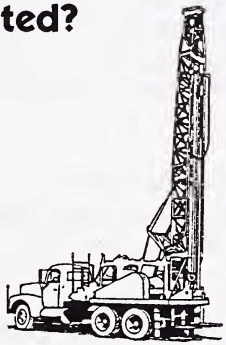
1. Locate the well close to the house. However, bear in mind that the pump needs to be serviced periodically, and easy access to the well should be maintained. Shorter horizontal and vertical distances between the well and the house decrease the ditching, piping, and amount of supply line needed.

2. Make sure the supply line from the well to the house is below the frost line — at least 5 feet deep in most areas. This will prevent line blockage and rupture caused by water freezing in the line during cold weather.

3. Try not to put patios, decks, driveways, etc., over your buried water supply line. If problems with the line arise, having these features over the line will increase the difficulty and cost of excavating the line. In addition, driveways or other compacted or paved areas can sometimes increase the depth to which frost penetrates below the ground surface.

4. Professional assistance is available from the MBMG and the DNRC for some well locations.

How Is a Good Well Usually Constructed?



Wells are commonly drilled by one of two methods. The first method, cable tool, uses a heavy, chisel-shaped bit, which is raised and lowered on a cable. The bit breaks up the rock into small pieces called cuttings, which are removed with a bailer. A bailer is a pipe with a valve on the lower end. The bailer is lowered into the well with the valve open. The cuttings flow upward into the bailer. When it is raised out of the well, the valve closes, and the material remains in the bailer until it is released outside of the casing.

The second method is rotary, which uses a bit attached to a hollow drill pipe. The bit and drill pipe are rotated. Drilling fluids or air are forced down the inside of the drill pipe and carry the drill cuttings to the surface through the space between the outside of the drill pipe and the drill hole. Other methods of well construction, less commonly used, include jetting, augering, and driving.

The drilled hole is lined with steel or plastic well casing. The casing, usually 4 to 8 inches in diameter, serves as a structural support to prevent caving of the hole and to shut out water of undesirable quality that is found in certain areas. If the well penetrates sound bedrock that will not cave into the hole, the casing needs to extend only through the loose overburden materials or 18 feet below the surface, whichever is deeper. Final casing length and diameter will depend on the depth of the well. Plastic casing, if used, must have a metal transition section extending at least 18 feet down from the ground surface and at least 18 inches above ground. The steel casing is important in guarding against contamination of the well because it prevents breakage of the casing near the surface, allows the space between the side of the drilled hole and the casing to be sealed (grouted) to prevent contamination, and accommodates the correct installation of pitless adaptors (if needed).

When the well ends in sand and gravel, a well screen may be placed in the water-bearing formation. The well screen is a sieve or strainer-like section of pipe that attaches to the bottom of the casing and extends into the water-bearing formation. The well screen allows water to enter the well while keeping sand from entering. Perforated pipe is sometimes substituted for a well screen. Preventing sand and gravel from entering the well is important to maintain good water quality in the well, reduce wear on pumps, and avoid plugging or other problems. The need for a screen or perforated casing will depend on the geological formations in your area.

Grouting is also an important step in constructing a well. Grouting is sealing the space between the side of the drill hole and the casing with an impermeable material, usually bentonite or cement. Generally, every well must be sealed in this manner to at least 18 feet below ground. Grouting is extremely important in guarding against well contamination because it prevents seepage of contaminants along the casing from the surface.

When artesian water is encountered in a well, the casing must be sealed to prevent surface and subsurface leakage from the artesian zone. The well must be equipped with a control valve if it flows at the surface, and it must be completed with seals, packers, and neat cement grout to eliminate leakage around the

well casing. Also, the driller is responsible to control the flow until the leakage has been completely stopped.

Section 85-2-505, MCA, requires that all flowing wells be capped or equipped with valves to stop the flow and waste of water when it is not put to beneficial use.

Installation of a properly sized pump is important to the function of your well. Too large a pump will result in overpumping, which can ruin the pump by allowing air to enter the pump (causing vibrations that can damage the pump) or by pulling sand into the well. Too small a pump will not give you the water you need. Your well contractor may be able to recommend the pump best suited for your particular situation. The size of the pump is determined by the expected yield of the well, how much water is needed, the diameter of the well casing, the distance between the house or storage tank and the well, and the difference in elevation between the water level in the well and the storage tank or house. You should not purchase a pump until your well has been drilled and tested to determine its yield.

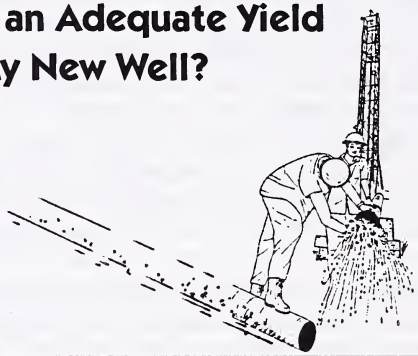
Finally, it is important that the well be thoroughly disinfected to kill any bacteria introduced during construction of the well or installation of the pump. The responsibility for disinfection and water tests should be addressed in the written contract between you and the contractor. Disinfection is accomplished by chlorination of the well with a dilute chlorine solution. Disinfection of the well before and after pump installation is required for all wells. Your contractor can fully explain this procedure.

Before the driller leaves the site, make sure he or she has placed a tight fitting cap over the top of the well casing. Capping a well tightly will reduce the risk of contamination or pump damage from something falling or being dropped into the well. Also, the ground surface around the well head should be graded so that it slopes away from the well. The contractor may not do this for you, so you may have to do it yourself.

The Board of Water Well Contractors has adopted mandatory water well construction standards. These are minimum standards required by law that must be followed by all water contractors and drillers during well construction to (1) protect groundwater and the well from

contamination, (2) help ensure good development of the well to maximize potential yield, and (3) provide an accurate record of the well construction procedures. Copies of the minimum standards are available from the Board of Water Well Contractors' office (address on back of this booklet).

What Steps Should Be Taken to Ensure an Adequate Yield from My New Well?



Various steps taken by the well driller during the construction of your well will affect its yield. Yield is governed by the formations encountered, depth to which the aquifer is penetrated, completion techniques used, and use of screens or perforations. It's important that the well owner be aware of why these steps are (or are not!) being taken by the driller in construction of the well.

Steps that maximize well yield include the following.

1. Make sure that your well extends an adequate distance into the water source or aquifer. This increases the efficiency with which water flows into your well from the aquifer, and at the same time allows your well to operate under conditions when water levels in the aquifer are lower, as they may be during a prolonged drought.

2. Increase the area of water entry into your well. In many geologic environments, unperforated wells that are open only at the end of the casing can provide adequate yields for domestic or stock-watering purposes. However, perforating or screening the well

where it is in contact with the water-bearing formations will improve the yield of any well, and is often necessary for larger yields or in less productive aquifers. Water-bearing formations typically include fine materials that reduce their ability to transmit water to your well. Removal of some of the fine-grained material from around the casing will improve the yield of the well. Well development is intended to accomplish this. A variety of techniques are used, depending on the geologic setting and the requirements of the well. These range from simple overpumping of the well until the water withdrawn is sand-free, to mechanical surging of the well, to high-pressure jetting of formations. All are intended to remove fine-grained material from the vicinity of the well openings, leaving in place coarser, more permeable material. All wells should be developed to where they provide sand-and-silt-free water; the need for additional development depends, again, on your water needs and on the geology of your area.

A pump test to determine the yield of your well is important. Water well contractors are required to test the well yield for at least one hour on all wells from which no more than 100 gpm will be withdrawn. A minimum eight-hour test is required for any well from which more than 100 gpm will be withdrawn. These are minimum standards for testing. Most mortgage companies require a longer test. The results of this test will be important in determining the correct size pump to install and the yield that can be sustained from your well.

Is My Well Water Safe to Drink without Treatment?

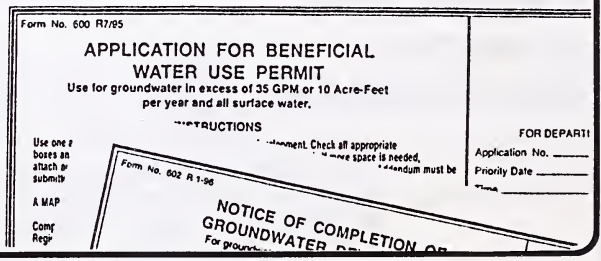
Generally, underground formations are the cleanest source of water. Most groundwater contains some minerals dissolved from the earth through which

the water has moved. These are rarely harmful to health and may give the water a pleasant taste. The geologic formations act as natural filters to screen out pollution. Shallow groundwater may be subject to contamination.

Water quality testing is important. Contaminants may be introduced during drilling and pump installation. Common water quality problems are high levels of coliform bacteria, nitrates, and total dissolved solids. High levels of coliform bacteria can indicate pollution from animal or human wastes. High concentrations of nitrates can indicate contamination by agricultural practices (fertilizer application or feed lots) or septic tank wastes. High concentrations of nitrates can cause health problems or death, particularly in infants and unborn babies. Concentrations in excess of 10.0 mg/1, as nitrate nitrogen, are of particular concern to families with pregnant women or infants less than one year old. Nitrate at these levels can interfere with the infant's ability to use oxygen, causing blue baby syndrome, a sometimes fatal condition. Total dissolved solids can cause an unpleasant taste and, at higher concentrations, may cause health problems. Proper testing to determine the presence of contaminants and proper disinfection will guarantee good quality water.

Aesthetic problems may be caused by hardness, iron, manganese, or iron bacteria. Information on treatment of these problems is available from your water well contractor, county sanitarian, county extension agent, or a water conditioning company.

Do I Need a Water Right?


Form No. 600 R7/95

APPLICATION FOR BENEFICIAL WATER USE PERMIT

Use for groundwater in excess of 35 GPM or 10 Acre-Feet per year and all surface water.

FOR DEPARTI

Application No. _____

Priority Date _____

Form No. 602 R 1-96

NOTICE OF COMPLETION OF GROUNDWATER

Yes. If you intend to use more than 35 gallons of water per minute, you will need to submit an "Application for Beneficial Water Use Permit"(Form 600) to DNRC before the well is drilled. If you intend to use

35 gpm or less, you are not required to obtain a permit, but you do need to file a "Notice of Completion of Groundwater Development" (Form 602) with DNRC within 60 days after you begin using the water. It is important for you to file this form to establish your legal right to use the water from your well. Filing of a "Well Log Report" (Form 603) with DNRC by the driller does not constitute filing your water right. Make sure you know the proper legal description of your well location, and include this information on both the well log and the water use permit application or notice of completion.

Permit applications and other information on appropriation of water are available from the Montana DNRC Water Resources Regional Offices.

What Should I Do to Maintain My Well after It Is Completed?

1. Most wells should be tested once per year for coliform bacteria contamination. These bacteria indicate contamination caused by animal or human waste. If your well is less than 25 feet deep, it could be particularly susceptible to contamination and should be tested several times per year and at least once during spring runoff.

The Permitting/Compliance Division of the Department of Environmental Quality in Helena (address on page 18) can be contacted for a list of labs that do this kind of test.

2. Wells that occasionally show signs of bacterial contamination should be disinfected on a continuous basis. Contact the Permitting/Compliance Division of the Department of Environmental Quality for information on how to properly disinfect your well and for recommendations on equipment to use for disinfection.

3. Many problems with the quality of well water are caused by bacteria that are not pathogenic, but affect the appearance of the water. These bacteria can produce undesirable tastes and odors, oily films, slime growths, and rust (red water).

Disinfection of the well can prevent these conditions from occurring or reduce their frequency. Your local county health department can give you information on how you can disinfect your well to prevent these problems. Its phone number and address are in your local phone directory.

4. It is a good idea to have the pump installer or driller install a small-diameter plastic tube in the well cap to allow monitoring of water levels in the well without having to remove the well cap. The tube's diameter should be large enough to accommodate a steel tape or well probe; typically, a 1/2-inch-diameter tube will suffice. The tube itself should be capped when not in use and the seams between the tube and the well cap sealed. Monitoring water levels in your well may be especially important during periods of prolonged drought, when the groundwater level can fall below the level at which the pump is set.

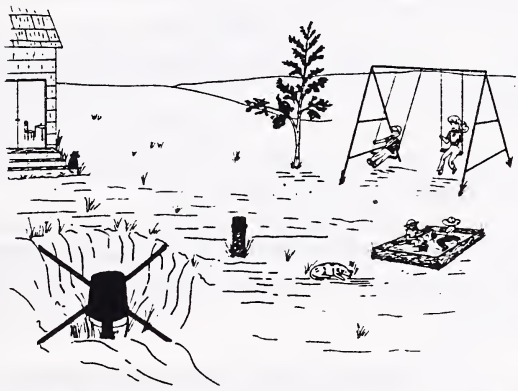
5. Back siphonage of contaminants into your well from fertilizer tanks, stock tanks, and pesticide residue can occur when your domestic water supply system shares a common distribution system with these facilities. If sharing a common distribution system is unavoidable, it is important to use equipment with proper backflow preventors to guard against back siphonage.

6. Make sure you routinely maintain your system; discuss a proper maintenance schedule with the individual who installs your system. Checking your system once a year should show any small items that, left unchecked, could become costly to fix.

7. Ask your contractor about abandoning a well that has been replaced. You are responsible for abandoning a

well that has been permanently discontinued or that may be considered a health hazard.

Do's and Don'ts



1. Do make sure that you have adequate groundwater for your proposed needs before you construct your home.

2. If you intend to withdraw more than 35 gallons of water per minute, do obtain a water right permit before your well is constructed.

3. Do make certain that you and the water well contractor fully understand and agree upon the terms of your agreement (whether it is verbal or written).

4. Don't hire an unlicensed driller. Ask to see a current license card.

5. Do consider sanitary requirements when locating your well. Do call the local or county officials for specific regulations or requirements in your area. Some areas have restrictions.

6. Don't ask your contractor to construct a well that does not meet the minimum water well construction standards. (To do so will result in probable future costs to correct deficiencies, as well as place the contractor's license in jeopardy.)

7. Don't purchase your pump prior to well construction.

8. Do select a pump and water system adaptable to your present and future needs.

9. Do have your well water analyzed to determine potability in all cases, and to determine mineral content if recommended by the contractor.

10. Do arrange to have your pump equipment serviced periodically.

11. Do consider your neighbor's present well and septic system location in locating your own.

12. Do obtain a copy of the well log on your completed well, including a bill of materials and record of work performed.

We have attempted to address all areas of concern that you may have when you are considering having a water well drilled. If you have questions on the material we have covered or on subjects that were not covered, please contact the Board of Water Well Contractors' office.

Agency Addresses

Board of Water Well Contractors
Department of Natural Resources and Conservation
48 North Last Chance Gulch
Helena MT 59620-1601
(406) 444-6643

Montana Bureau of Mines and Geology
Montana Tech of the University of Montana
1300 West Park
Butte MT 59701-8997
(406) 496-4336

Montana Bureau of Mines and Geology
Eastern Montana College
Box 112
Billings MT 59101
(406) 657-2938

Permitting/Compliance Division
Department of Environmental Quality
PO Box 200901
1520 East Sixth Avenue
Helena MT 59620-0901
(406) 444-4549

DNRC Water Resources Regional Offices

1537 Avenue D, Suite 121
Billings MT 59102
(406) 657-2105

151 Evergreen Drive, Suite C
Bozeman MT 59715
(406) 586-3136

PO Box 1269
630 Third Avenue South
Glasgow MT 59230-1269
(406) 228-2561

PO Box 1828
1708 West Second Street
Havre MT 59501-1828
(406) 265-5516

PO Box 201601
21 North Last Chance Gulch
Helena MT 59620-1601
(406) 449-0944

PO Box 860 (zip 59903)
3220 Highway 93 South
Kalispell MT 59903-0860
(406) 752-2288

PO Box 438
613 NE Main
Lewistown MT 59457-0438
(406) 538-7459

PO Box 5004
Town and Country Shopping Center
1610 South Third Street West, Suite 103
Missoula MT 59806-5004
(406) 721-4284

Other information available from the Board of Water Well Contractors' office in Helena:

Copies of the Board of Water Well Contractors' law and rules..... $ 4.00

Board of Water Well Contractors
PO Box 201601
48 North Last Chance Gulch
Helena Montana 59620-1601
(406) 444-6643

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